Q.P. Code :09556

[Time: 3 Hours] **[Marks:80]**

Please check whether you have got the right question paper.

N.B: (1) Question No.1 is compulsory.
(2) Attempt any three questions from question No.2to 6.
(3) Use illustrative diagrams whenever required.

1. (a) Explain the term (i) Vapour pressure (ii) Compressibility. **05**
(b) What is streamline in Fluid kinematics? Explain its charactestrics of Streamlines. **05**
(c) What do you mean by repeating variables? How are the repeating variables selected For the dimensional analysis? **05**
(d) Differentiate between an impulse and reaction turbines. **05**

2. (a) Draw and discuss the operating characteristics of a centrifugal Pump. **06**
(b) Derive Euler equation of motion along a stream line for the ideal fluid stating clearly the assumptions. Explain how this s integrated to get Bernoulli's equation along a stream –line. **10**
(c) A solid cylinder of diameter 4.0 m has height of 3 meters. Find the meta-centric height of the cylinder when it is floating in water with it axis vertical. The sp. gr. Of the cylinder=0.6 **04**

3. (a) What is Hagen Poiseuille formula? Derive an Expression for Hagen Poiseuille formula. **08**
(b) Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump? **04**
(c) A reaction works at 450 r.p.m. under a need of 120 meters. Its diameter at inlet is 120cm and the flow area is 0.4 m2. The angles made by absolute and relative velocity at inlet are 20˚ and 60˚ respectively with tangential velocity. Determine: (a) The volume flow rate (b) the power development and (c) Hydraulic efficiency. Assume whirl at outlet to be zero. **08**

4. (a) The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity, viscosity μ and density ρ. using Buckingham's π-theorem, obtain an expression for Δp. **12**
(b) List the minor energy losses in pipes. Explain any three in detail with derivation. **08**

5. (a) The internal and external diameter of an impeller of the centrifugal pump which is running at 1000 r.p.m., are 200 mm and 400 mm respectively. The discharge through pump is 0.04 m^3/ s and velocity of flow is constant and equal to 2.0 m/s. The diameter of suction and delivery pipes are 150 mm and 100 mm respectively and suction and delivery heads are 6m (abs.) and 30 m (abs.) of water respectively. If the outlet vane angle is 45^o and power require to drive the pump is 16.186 kW, determine: (i) Vane angle of the impeller (ii) The overall efficiency of the pump, and (iii) Manometric efficiency of the pump. **10**
(b) Explain Flow through pipe in series and in parallel. **04**
(c) A 40 cm diameter pipe, conveying water, branches into two pipe of diameters 30 cm and 20 cm respectively. If the average velocity in the 40 cm diameter pipe is 3 m/s. Find the discharge in this pipe. Also determine the velocity in 20 cm pipe if the average velocity in 30 cm pipe is 2 m/s. **06**

[P.T.O]

6. (a) The hub diameter of a Kaplan turbine, working under a head of 12 m, is 0.35 times the diameter of runner. The turbine is running at 100 r.p.m. If the vane angle of the extreme edge of the runner at outlet is 15^{o} and flow ratio is 0.6, find: (i) Diameter of runner, (ii) Diameter of boss, and (iii) Discharge through Runner. The velocity of whirl at outlet is given as Zero. **06**

(b) A circular hollow plate having 3.0 diameter and concentric circular hole 1.5 m, is immersed in water in such way that its greatest and least depth below the free surface are 4m and 1.5 m respectively. Determine the total pressure on face of the plate and position of centre of pressure. **10**

(c) A shaft of 100 mm diameter is roating inside a journal bearing of diameter 102 mm at a speed of 360 R.P.M. the between shaft and bearing is filled with a lubricating oil of viscosity 5 Poise. The length of bearing is 200mm. Find the power absorbed in lubricating oil. **04**

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